Learning Goals

1. To be able to identify whether a relation is linear or non-linear using a graph.

2. To be able to identify whether a relation is linear or non-linear from an equation.

3. To be able to identify whether a relation is linear or non-linear from first differences.

4. To be able to identify whether a relation is linear or non-linear from slope calculations.

3.5 Linear and Non-Linear Relations

Key Ideas

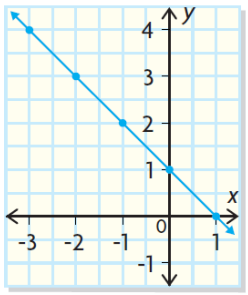
If a relation is non-linear, then the following are true:

1. The graph is not a straight line.
2. The first differences are not constant.
3. The degree of the equation is not one.
4. The slope between pairs of points is not constant.

Example One

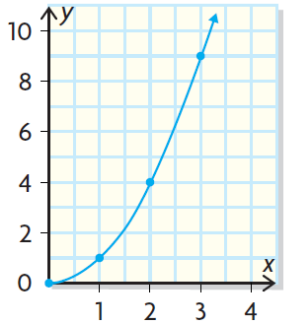
Identify each graph as either linear or non-linear. Explain why.

a)



Linear b/c it is a straight line.

b)



Non-linear b/c it is not a straight line.

Example Two

Identify each relation as linear or non-linear. Explain why.

a)

x	y	1st Differences
1	5	
2	10	10-5=5
3	15	15-10=5
4	20	20-15=5

Linear b/c 1st diff. are constant.

b)

x	y	1st Differences
1	1	
2	4	4-1=3
3	9	9-4=5
4	16	16-9=7

Non-linear b/c 1st diff are not constant.

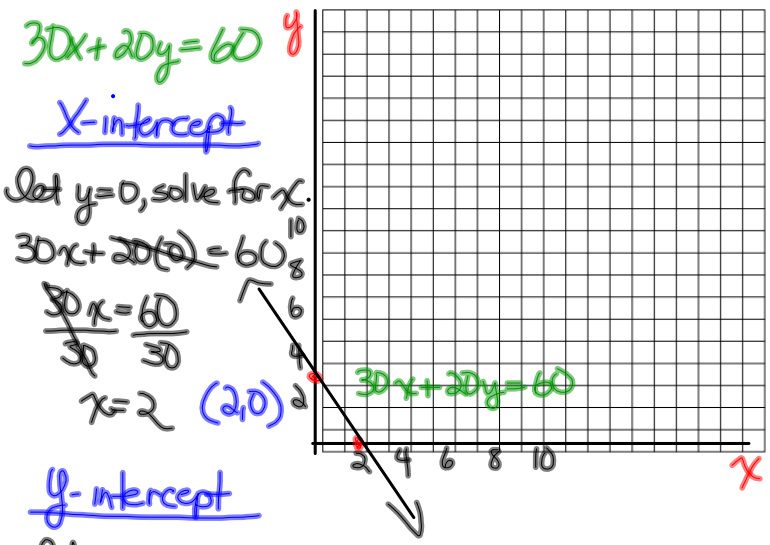
Example Three

A boat travels 30 km/hr one direction, turns around and then travels 20 km/hr back the other direction. The boat travels 60 km in all.

a) Determine whether the equation $30x^{1} + 20y^{1} = 60$ is linear or not. How do you know?

Linear b/c the equation is degree 1.

b) Use a graph or table to confirm your answer.



30x+20y=60

X-intercept

let y=0, solve for x.

30x+20(0)=60

$\frac{30x}{30} = \frac{60}{30}$

x=2 (2,0)

y-intercept

let x=0, solve for y.

30(0)+20y=60

$\frac{20y}{20} = \frac{60}{20}$

y=3 (0,3)

Complete: p. 179 - 181 # 1 - 3, 7(graph), 8 (create a table and use first differences).

p180 #7.

$G = 80 - 0.2k$

(G = y, k = x)

k-intercept

Let $G = 0$ & solve for k.

$0 = 80 - 0.2k$

$-80 = -0.2k$

$\frac{-80}{-0.2} = \frac{-0.2k}{-0.2}$

$k = 400$ (400, 0)

G-intercept

let $k = 0$ & solve for G.

$G = 80 - 0.2(0)$

$G = 80$ (0, 80)

p. 180
#8

a) $C' = 0.006(R' + 20)$

d/ind.

linear b/c degree 1.

b)

R	C
0	$0.006(0+20) = 0.12$
10	$0.006(10+20) = 0.18$
20	$0.006(20+20) =$
30	$0.006(30+20) =$